Development of a grid-based bookkeeping carbon accounting model for fine scale (30m) carbon estimation

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Science Questions

- How to quantify the carbon fluxes arising from contemporary forest disturbances with adequate spatial details needed to support carbon management at levels where decisions by individual land owners matter?
- To what degree these flux estimates are affected by remote sensing products?

Analysis

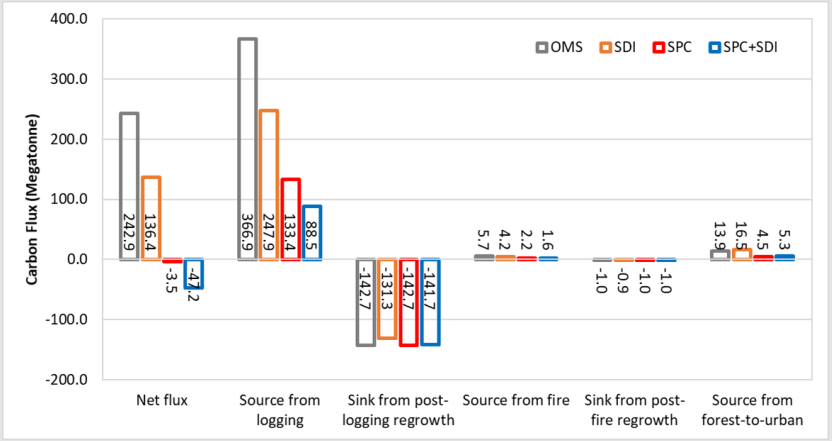
- A grid-based carbon accounting model (GCA) was developed by improving an existing bookkeeping model (Houghton et al. 1999) and implementing within a grid-based framework;
- The model was used to derive 30m carbon flux estimates for North Carolina's forestland that had disturbances in recent decades (1986-2010);
- Model inputs included several remote sensing products, including an existing forest carbon map (Wilson et al. 2013), vegetation change tracker (VCT) disturbance products (Huang et al. 2010), disturbance intensity data derived from Landsat spectral indices and forest plot data (Tao et al. 2019), fire maps (Eidenshink et al. 2007), and a land cover product (Homer et al. 2015).

Results

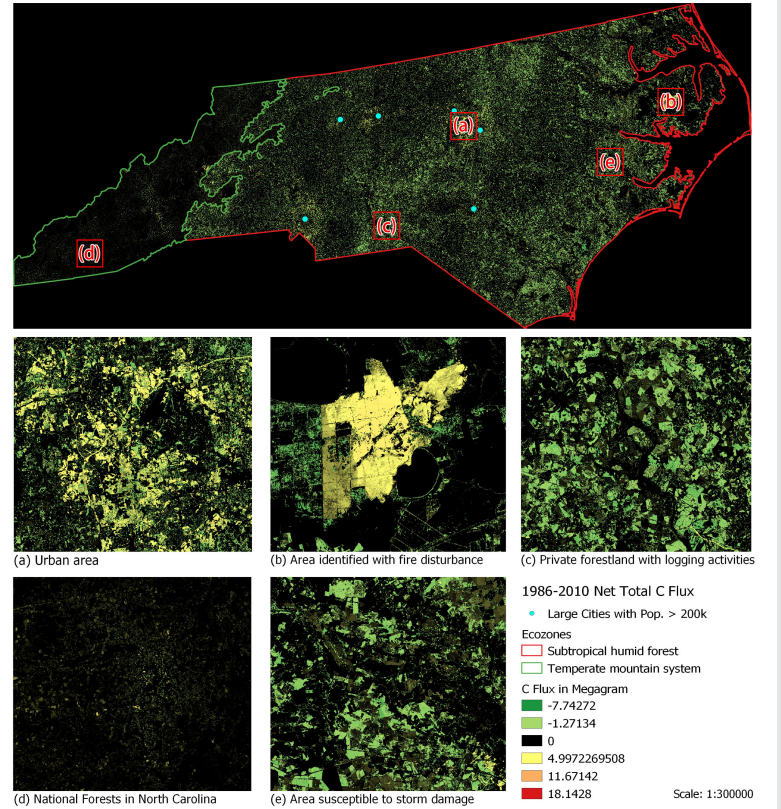
- Carbon fluxes arising from wood harvesting, fire, and conversion to urban land in North Carolina were mapped at the 30 m resolution.
- Use of remote sensing products, including biomass and disturbance intensity data had large impact on carbon estimation, including the emission from logging and the next flux.

Significance

- Integration of a widely used bookkeeping carbon accounting model with increasingly better remote sensing products will greatly improve the estimation of carbon fluxes arising from contemporary forest disturbances.
- The fine spatial details provided by this modeling framework are critical for carbon management at local and individual land owner levels.



Flux estimates derived by using disturbance intensity (SDI), biomass map (SPC), or both (SPC+SDI) were very different from those derived using parameters of the original bookkeeping model (OMS), suggesting that large improvements could be achievable by using increasing better remote sensing products.



A 30m map of net carbon flux arising from forest disturbances (1986-2010) in North Carolina. The zoom-ins show the spatial details over areas that had (a) extensive forest-to-urban conversion, (b) a large fire, (c) active wood harvesting followed by strong growth, (d) minimal disturbances, and (e) storm damage/salvage logging followed by recovery.

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